INTERNATIONAL LEVEE PERFORMANCE DATABASE

LEVEEFAILURES.TUDELFT.NL

PROVIDING A GLOBAL PLATFORM FOR SYSTEMATICALLY COLLECTING AND SHARING DATA ON LEVEE PERFORMANCE AND FAILURE CASES.

TU Delft

LEVEL 01 — **METADATA**

CREST LEVEL
MATERIAL
PEAK DISCHARGE
RETURN PERIOD
BREACH WIDTH
FLOODED AREA
DAMAGE
REFERENCES

LEVEL 02 — **INTERMEDIATE**

TIME SERIES
SOIL PROFILES
LOADING CONDITIONS
MODELLING RESULTS
REPORTS
HINDCAST ANALYSIS

LEVEL 03 — **DETAILED**

DETAILED INFORMATION OF FAILURE EXPERIMENT DATA

APPLICATION OF DATABASE

FOR RESEARCHERS, CONSULTANTS AND LEVEE MANAGERS

DESIGN, ASSESSMENT AND MANAGEMENT

CLOSE THE GAP BETWEEN MODEL CALCULATIONS AND PRACTICE

IMPROVE MODELS FOR PIPING AND STABILITY

USE OF **FAILURE PATHS**

CRISISMANAGEMENT

LEARN ABOUT AND **RECOGNIZE** FAILURE MECHANISMS

CREATING **AWARENESS** FOR **INSPECTION**

HINDCASTING OF FAILURES AND BREACHES

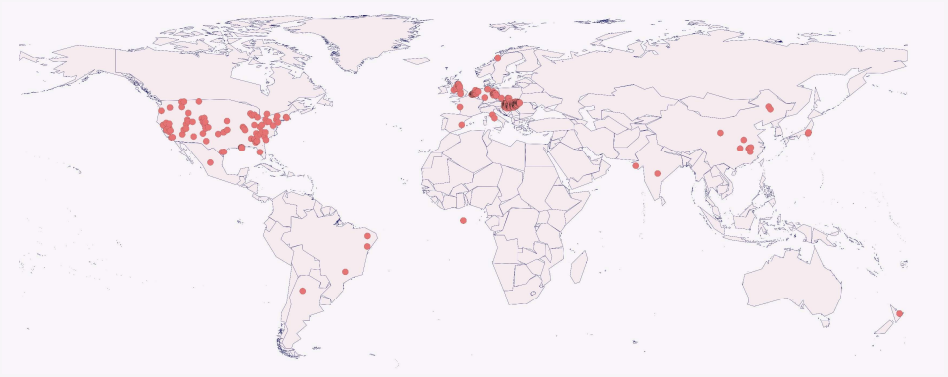
RESEARCH ON IMPLEMENTATION OF **EMERGENCY MEAUSURES**

DATA SCIENCE

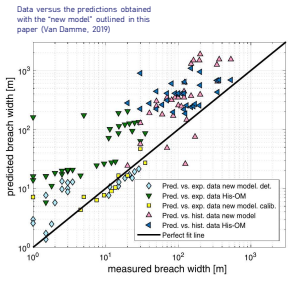
DATA-DRIVEN RESEARCH TO ENRICH PHYSICAL KNOWLEDGE

ANALYSIS WITH **STANDARDIZED INFORMATION** ON BREACHES AND FAILURES

EFFICIENT COMBINATION WITH **OTHER DATA SOURCES**, LIKE LEVEE DEFORMATION



1000 EVENTS
1500 FAILURES
35 EXPERIMENTS
15 COUNTRIES
IMAGES & VIDEOS



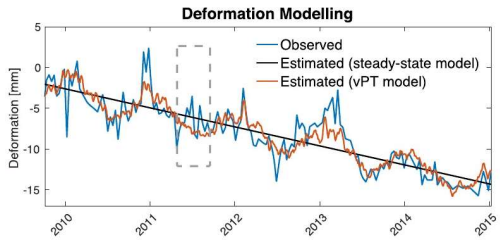
Data versus the predictions obtained with the "new model" outlined in this paper (Van Damme, 2019)

VALIDATION OF MODELS

With use of the ILPD a model for **prediction** of **breach growth** was **validated** based on real failures. With this new model it is possible to do an accurate prediction of breach widening, essential for flood risk assessments.

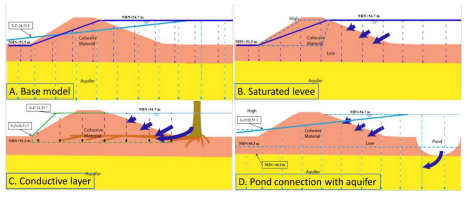
COMBINATION OF DATA SOURCES

Satellite data can become an important source of data for flood defense management. this study looked at whether it is possible to observe **deformation** of flood defenses. depending on the subsoil characteristics, a dike shrinks and grows to a greater or lesser extent, which can be an indication of weakness. The ILPD helps to **validate** this **research** and to **investigate** historical **deformation** at locations of failure.



Insight in levee deformation: local deformation of regional levee at Delfland (Ozer, 2019)

View of the four possible scenarios derived from the data analysis. Kool (2019)

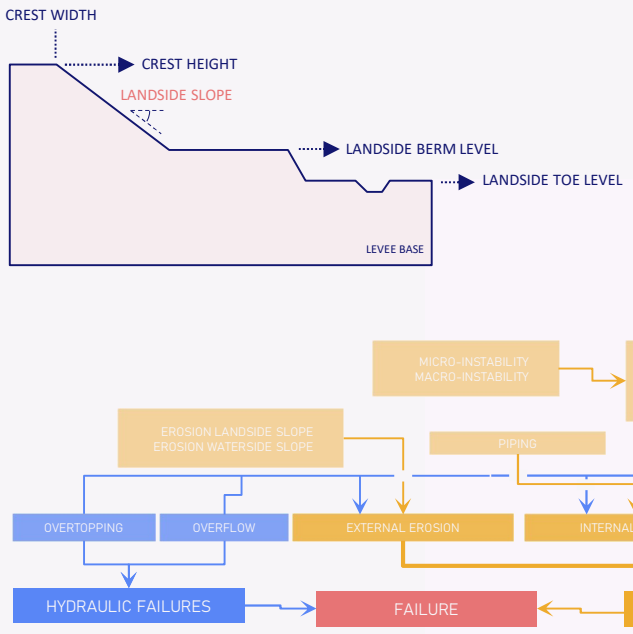


FORENSIC ANALYSIS OF FAILURES AND IMPROVEMENT OF MODELS

Kool (2019) analyzed the **failure** of the levee in **Breitenhagen**, which occurred due to **instability** in the year 2013 during the Elbe river floods (Germany). He analyzed the causes of failure and performance of stability models. Based on the information **prior**, **during** and **after** the **breach** of the levee, a slope **stability model** was developed for the entire event.

RECENT WORK

- **PHD THESIS OF ECE ÖZER:** UNDERSTANDING LEVEE FAILURES FROM HISTORICAL AND SATELLITE OBSERVATIONS. WHICH USES SATELLITE DATA TO DETECT LONG-TERM AND SEASONAL DEFORMATIONS IN DIKES (SEE LEFT SIDE OF FIGURE BELOW), TO AID IN THE PREDICTION OF FUTURE FAILURES.
- **JOURNAL ARTICLE BY JOB KOOL:** FORENSIC ANALYSIS OF LEVEE FAILURES: THE BREITENHAGEN CASE, WHICH DEVELOPS SYSTEMATIC HINDCASTING OF HISTORICAL LEVEE FAILURES (RIGHT SIDE OF FIGURE).
- **JOURNAL ARTICLE BY MYRON VAN DAMME**: AN ANALYTICAL PROCESS-BASED APPROACH TO PREDICTING BREACH WIDTH IN LEVEES CONSTRUCTED FROM DILATANT SOILS.



STANDARDIZATION

The ILPD uses **standardized** terms for **levee elements** and **failure mechanisms** (see left and below)

HIGHLIGHTED ENTRIES

IMPACT LAB EXPERIMENTS, NORWAY, 2002. (5 FAILURES - LEVEL 3 DATA)

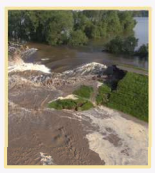
3 full scale breach experiments with varying soil properties. failure caused by overtopping and piping. detailed technical reports are available for each failure.

HURRICANE KATRINA, USA, 2005. (11 FAILURES - LEVEL 2 DATA)

11 recorded failures from different parts of New Orleans and surrounding areas. Extensive reports are available for each failure.

ELBE RIVER FLOODS, GERMANY, 2002. (111 FAILURES - LEVEL 3 DATA)

Exceptional precipitation caused extreme flash and river floods in many rivers in Germany. 111 levee breaches are recorded combined with performance data on levee sections that did not fail despite being subjected to high loads.



MORE INFORMATION

WE WELCOME NEW CONTRIBUTIONS AND USE OF THE DATABASE. WOULD YOU LIKE TO SUBMIT ENTRIES? OR NEED MORE INFORMATION?
VISIT LEVEEFAILURES.TUDELFT.NL OR CONTACT US AT LEVEEFAILURES@TUDELFT.NL